THE ELECTRICAL WORLD

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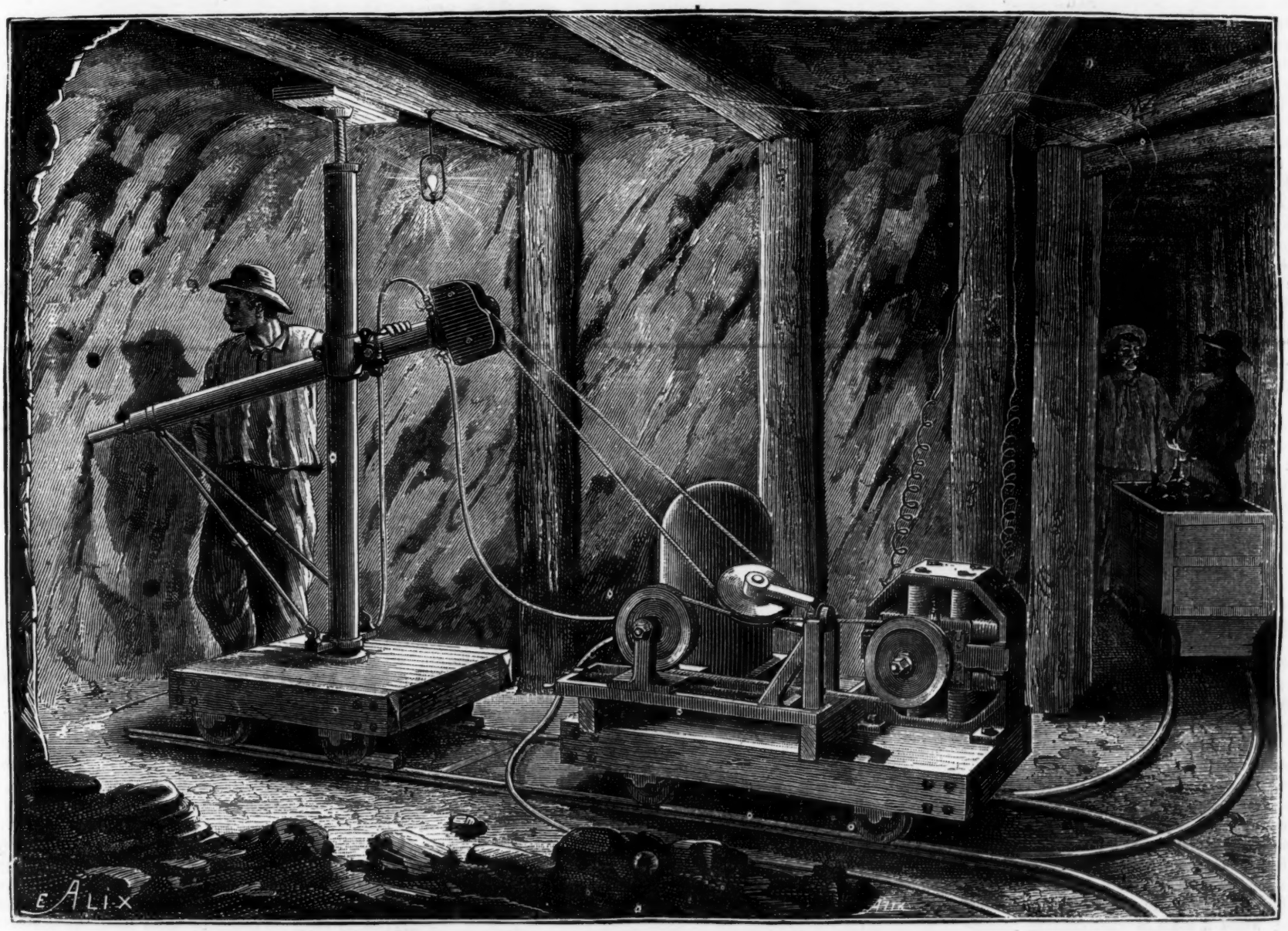
Electric Drilling in Mines.

As an instance of the effective transmission of power by electricity, we mentioned last week the railway in the Oppel mines, Saxony. It is clear from that experiment, and from many others, that to supply light and power for subterranean work of all kinds, electricity is the best means as regards safety and convenience which could be employed.

One of the most important departments of mining operations is drilling and tunneling, and naturally as the beds and strata of rocks and minerals near the surface of the earth become exhausted, shafts and galleries are carried deeper and deeper, with a correspnding increase in the number and extent of the difficulties that tend to hinder the successful exploitation of rich deposits. But, thanks to the progress in electric lighting and in the transmission of power, work can be carried on at a greater depth below the surface than ever before, with a decrease of danger and expense. Electricity is now applied to the most varied work in mines, and is found equally available in illuminating the galleries about which float gases of noxious character, in piercing rocks, in hoisting and pumping, and in ventilating; and its use enables the apparatus to be made in small and compact form, the generator of current or prime source of power being at a distance.

We reproduce to-day from *La Lumière Electrique* a fine cut illustrating the Taverdon drill, with electric motor, used in boring subterranean galleries. This invention is a striking example of the transmission of power and the application of electricity to a new and difficult kind of work. Numerous systems of rock drills have been in favor from time to time, the apparatus being run by steam or compressed air, but it is asserted on behalf of this new plan or device that it is far less cumbersome and far more easy to control than any of its predecessors. M. Taverdon applies electricity to a rotary drill, which is worked by a motor in the manner indicated. In his system, the drills carry at their "business end" black diamonds, capable of penetrating the hardest rocks. In order to fix the diamond solidly, so as to keep all its facets properly at work, Mr. Taverdon employs a hard metallic solder that fills all the cavities. As he could not apply the solder directly to the stone, he first covers the latter by electrolysis with a thin coating of copper. This allows the application of the solder, but does not interfere at all with the parts of the diamond presented to the rock. A special carriage is provided both for the perforator and for the motor. The perforator is fixed upon an upright column adjusted by a spiral spring to the roof and floor of the galler in such wise as to keep the platform of the car on which it is mounted perfectly steady. It is capable of movement on vertical and horizontal axes, and thus can be set in any desired position. The butt end can be fitted with an ingeniously constructed motor, with a view to the use of steam, compressed air, or hydraulic pressure, indifferently, for driving, but in the electrical arrangement a box replaces the motor and a simple pulley receives and turns with the belt or cable connecting with the electric motor on the rear car. The motor consists of a Gramme octagonal machine, similar to that used in the famous plowing experiments at Sermaize, and its strong cast-iron frame evidently fits it for rough mining work. The pulley at the end of the axis of the motor transmits the power to the box at the end of the drill by the cable, which passes over two other pulleys as shown, one of the latter being adjustable. The generating machine is, of course, outside the gallery at any convenient distance.

On the car carrying the motor is a water tank, from which water is forced to the perforator and is then used to wash away the sand as quickly as it is formed and accumulates. We ought to say here that in another drilling machine of M. Taverdon, the drill or boring tool is fitted direct to the axis of the motor, which is driven in the usual way and is carried on a car. This plan is simpler than the other and apparently more economical of power, but M. Taverdon speaks highly of the apparatus shown in the illustration and reports that from it he has obtained results equal to those of the best steam drills and better than those with compressed air. The advantages of the use of electricity for this work are easy to see. The little gallery is not cramped and choked up with steam, air or water pipes, which besides occupying valuable space, are liable to leakage and sometimes stop the work while their defects are being remedied. A noteworthy feature of the scene is the use of the incandescent lamp; and if necessary the blasting charge in the drill holes can be fired by an electric current.



THE TAVERDON ELECTRIC DRILLING APPARATUS FOR MINES.

Electric Lighting at the London Health Exhibition.

An International Exhibition of any kind would, in addition, most certainly prove a marvelous exhibition of punctuality if it were at all in a state of tolerable order on the appointed day of opening. Even at the present time of writing, says the *Mechanical World* of July 10, more than a month having elapsed since the great show at South Kensington was formally declared upon—there are still several sections in a condition of partial chaos, and many others cannot, from the nature of exhibits and the tardiness of the exhibitors, be in full working order for some time yet to come. Light of any kind, however, natural and artifical, becomes so absolutely necessary in carrying on these vast shows, that visitors will not fail to be struck

at once with the advancement and completeness of the electric lighting department. The machinery is grouped together under a large wooden shed lying between the great south gallery—devoted to foods and food produce—and the street of old houses, typical of mediæval London.

The engines are six in number, three being of the semi-portable class carrying their own boilers; the fourth, a fixed compound engine; the fifth and sixth two pairs of fixed high pressure engines, fed from six large boilers of the locomotive type. The cylinders are in size respectively:—Semi-portable No. 1, two 10½ in. diameter; semi-fixed, No. 2, two 12 in. diameter; compound semi-fixed cylinders 12¼ in. and 20 in. diameter; fixed compound engine, 15 in. and 22½ in. diameter; first pair of coupled engines, 18½ in. diameter, with flywheel 12 ft. in diameter; second pair 19½ in. diameter, with two flywheels also 12 ft. in diameter.

Down the middle of the oblong shed runs a great central line of counter-shafting, actuated by one of the semi-portable engines and the two pairs above named, and from which are driven between thirty and forty dynamo machines. Starting from the eastern end there are Siemens alternating current machine, with exciter; four machines shown by the Pilsen-Joel Company; two belonging to the Electric Sun Company, whose arc lamp is practically an ingenious application of electricity to the lime-light; another Siemens alternating machine with exciter, and further on a set of five machines from the same firm, arranged on slide bars so that the belts may be kept stretched tight.

From a second and smaller line of counter-shafting are driven two Crompton machines, and three of Gramme's, all direct dynamos, and finally, a large set of Edison machines, ten in number, sliding on small tee rails, and arranged with set screws in order to tighten up the driving belts. The majority of these latter are made of link leather; some of the machines, however, are driven by means of canvas belting, which is certainly cheaper. In addition to the above named dynamos there is one of the new Victoria machines, suitable for arc or incandescent lighting, or both at once. This is driven direct by one of Parson's patent silent rotary engines, made by Kitson, of Leeds.

From the far end of the central shafting is driven an alternating machine with exciter, made by Oppermann Bros. and there is also a good display of machinery by the Hochhausen Company, who have two Excelsior dynamos, Nos. 4 and 5. The field magnets of these are of a circular shape, the armature being a modification of the well-known Gramme ring. There is also to be noticed a large 40-light Brush machine standing close by, and driven from the same counter-shaft.

Altogether there are on this line of shafting nearly forty dynamos, and this arrangement in itself would form an admirable exhibition of electric lighting. There are still, however, many others to notice, and chief of these may be mentioned a display of four alternating Gramme machines used for working the Jablochkoff candles. These are driven by one of the semi-portable engines, consisting of a locomotive boiler, with pair of high-pressure cylinders fixed below.

The remaining two engines are both compounded, one, consisting of a pair, being fixed, the other semi-portable, and each drives a small line of counter-shafting. From the former are worked two large Brush machines, and also one of the new Ferranti alternating machines, with a Siemens direct current dynamo to excite its field magnets, coupled on the same shaft. From the semi-portable compound engine are driven, through a counter-shaft, a set of six Gulcher machines of various sizes and capacities, and also a single machine of the same maker. The two large pairs first spoken of exhaust their steam into the uptakes of four out of the six large locomotive boilers; of these the remaining two, in the centre of the row, obtain a draught by means of live steam.

Looking now from the sources of electrical power to its application we may note that the number and brilliancy of arc and incandescent lamps fairly surpasses all that has hitherto been attempted. Perhaps the display of light may be seen at its best from the entrance hall in Exhibition Road. Overhead are two enormous electroliers of surpassing beauty, both in design and execution, each glow lamp being made to give the appearance of a flower or bud amid a mass of surrounding foliage. Looking straight on may be seen the long south gallery, whose arched roof is covered with nearly a thousand incandescent lamps arranged in some fifteen or twenty rows. The effect given by these long lines of lamps is very striking, though not so pleasing as the grouped light. In the centre of the grounds is erected a mast on which burn six large arc lamps, unfortunately placed almost too high to light up the gardens just below. Of the other lamp arrangements it is almost impossible to speak. Nearly every section in the exhibition has arc or incandescent lights brilliantly showing up the objects of interest, and with a few or no exceptions they all burn admirably well. In short the intending visitor may feel perfectly sure that in going to the Health Exhibition he will also see the best and most complete show of electric light apparatus that has ever been brought together.

A NEW LINE IN MEXICO.—A new line of telegraph is being constructed from Actopan to Tulu and Huichacan, in Hidalgo, Mexico

Improvements on Blake Transmitters.

It is well known, says the London *Electrician*, that Blake's improvement on Edison's transmitter is the most approved of all telephone transmitters. It is not so widely known that there are three weak points in it, which have hitherto been regarded as so inseparable from the Blake system, that the most experienced telephone managers have for special purposes fallen back upon the original Edison and other instruments.

The reasons for this compulsory resort to anterior inventions are these:—

Firstly—There is no provision to exclude the fine dust incessantly floating about in every-day atmosphere, but which in all towns and cities is so profuse that it penetrates every cavity to which there is access, through any crack or crevice, however fine. The electric current attracts this dust between and around the point of contact on the carbon button, until in a few weeks at the least the articulation of the voice becomes so muffled and broken up by the transmitters, that after many annoyances and interruptions from this unknown, and perhaps unsuspected, cause, the assistance of an official inspector is required to remove the impediment.

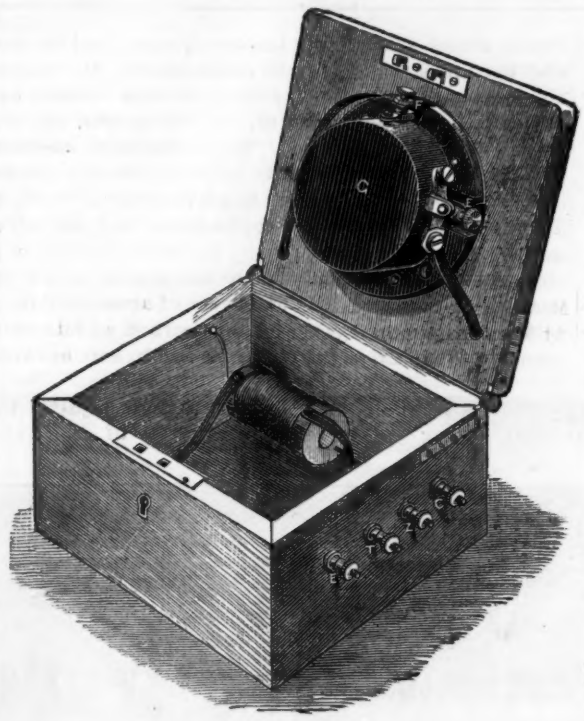


FIG. 1

Secondly—In addition to the dust impediment there is a process of wear and tear that destroys the particles of carbon which make contact with the platinum point at the end of the slender spring. If the instrument is delicately adjusted so as to respond to faint or distant sounds, which, for the moment, show off to the greatest advantage the beauty of the Blake invention, the destruction of the carbon particles is correspondingly more rapid.

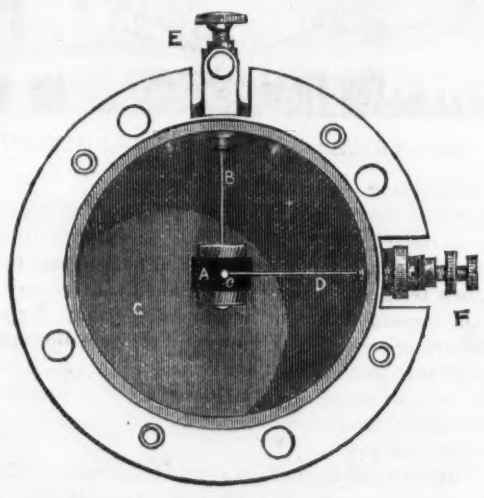


FIG. 2.

Hence, although the exclusion of dust lessens the evil, the natural action of the instrument produces a dirty ash, which causes similar annoyance and obstruction.

Thirdly—In consequence of the action just described, it is impossible to employ more than one battery cell where a louder voice or its transmission to long distances is required.

A remedy for this latter defect has been devised and patented by Mr. Moseley. To remedy the first defect by the exclusion of dust the microphone action is inclosed in an air-tight box *G* (Fig. 1), the opening of which is closed by the diaphragm. To remedy the second defect, the carbon electrode *A* (Fig. 2) is made of a short cylindrical form, supported on the end of a stout brass wire spring *B*, which is attached to a screw terminating in the milled head *E*. The platinum electrode *c*, platinum head on the end of the light silver wire wire spring support *D*, ending in the milled head *F*.

It will be seen, therefore, that when the transmitter produces any buzzing or confused sounds, the terminals *E* and *F* may be instantly turned very slightly, which will at once present fresh material for the points of contact, and instead of keeping in order only one or two months, as alleged against the present instruments, there seems no reason why, with the improvements described, there should be any necessity for official attendance for ten or twenty years.

Underground Conductors for New York.*

BY GEO. M. COGGESHALL.

The subject of underground conductors for electrical purposes is becoming of more importance yearly in all large cities. It is apparently the intention of electric companies to place their conductors below ground as soon as they find some feasible system of doing so. Let us therefore consider what are the features in the various systems now in use here.

There are several pipe-line systems, notably the one used by the Western Union Telegraph Company. This consists of an iron pipe into which there are drawn gutta percha insulated wires. It answers their purpose, as their offices are widely separated, but is evidently unsuitable for telephone or messenger service on account of making the frequent connections required. The same objections may be made to the various lead insulated cables, or to any cable system containing a large number of wires.

We have also the system adopted by the Edison Electric Light Company for serving electricity for their incandescent light. This is, probably, the most extended and successful experiment in underground service of electricity ever made. But while this system answers for electric lighting companies it is not adapted to the requirements of the others. A comprehensive system is required that will allow each and all of the various companies to serve their patrons according to their particular wants. Let us consider, therefore, what are the requirements of an underground system for the numerous electric companies in New York City.

First: That all conductors should be free from induction.

Second: That the telephone, district messenger, burglar alarm and various automatic telegraph companies, should have separate insulated conductors so arranged as to be readily accessible for connection with every house or building.

Third: That all conductors for the electric light should have branches to each building, and at suitable points for street illumination.

Fourth: That all wires for trunk line telegraph companies should be accessible for repairs, tests, etc., at all times, without disturbing the surface of the street.

The only system that will satisfy these requirements must be an arrangement of the conductors in a conduit. This, in all sections of the city heavily wired, should be sufficiently large to admit a person throughout its length for the purpose of laying wires, making connections, tests and repairs.

A conduit of this kind would only be used in the most important avenues and streets running north and south, also in the best business streets down town, as the paying business of the telephone, messenger and automatic telegraph companies is located below Chambers street, east of Washington and west of the Bowery, with a narrow section extending up Broadway to Forty-second street. For electric service in the residence portion of the city the large conduits would be extended up the avenues, with service conductors to each house; but here we do not need so many kinds of electric service as in the business section. The electric light becomes in this region of first importance, the telephone and messenger services next, the burglar alarm and time telegraph next. This makes only five different systems, and I would suggest that the telephone, district messenger, and burglar alarm, could be consolidated, and the number of wires reduced, by the use of a modification of some such systems as those of M. Van Rysselberghe and the Stabler Individual Call. If so, it would simplify matters very much. For this small number of conductors the crosstown streets could use a conduit near the surface of the street, with connection boxes in front of the dividing line of every two houses. Connections could then be made by hand from the street. There *are* already one or two inventions with this end in view.

We will now discuss the various kinds of conductors needed for the different systems. The telephone, being the most easily affected by induction and requiring connections at every building, necessitates the use of separate insulated conductors. The various automatic systems and the messenger service require the same. The telegraph companies, owing to the long distance between offices, could use any of the cable systems, allowing one or more to each company. For the electric light some sectional system of large conductors is necessary, preferably those wound with cotton dipped in compounds of wax, rosin, etc., and incased in lead. The use of conductors incased in iron pipes would not be advisable. The selection of insulated conductors and the construction of conduits are matters that our electricians and engineers are fully competent to determine. Having decided upon a feasible plan, we will next arrange for the construction and management of the conduit. Evidently it would not do for a private corporation to build or manage it, therefore the electric

* A paper read before the New York Electrical Society, July 9, 1884

companies should organize a separate company managed by a board of directors chosen from each company, the stock to be equitably divided among the various companies, the underground company to make all connections, repairs, tests, etc., and do all work connected with its department. As to the cost of such an undertaking, from actual experiments made recently in Boston, and from careful approximate calculations made here in New York, a system such as we have mentioned, for the down-town district, would cost about $1,500,000 per square mile; the residence section would cost about $1,000,000 per square mile, meeting all the present and prospective wants of all the electric companies.

The people, who are served, are asking too much when they demand that all wires shall go under ground. This is probably the dividing line between the people and the electric companies. As an illustration of what I mean I would say that the heaviest business carried on by telephone is between the various commercial houses and exchanges, and the railroad, steamboat and steamship docks, and yet the telephone company get for this the rent from only one, or at the most two, instruments on each dock. The cost of putting conductors under ground to these distant points would be immense. The same objections hold good for all the outlying residence and manufacturing sections. It will apply equally to the messenger service and to the electric light companies.

The just and proper thing to do is to let this unreasonable cry, "The wires must all come down," cease, and cause to be placed one or two conduits through from the Battery to the Harlem River for all the trunk lines. That would do away with all the heavy poles and the bulk of all the wires. Then put the wires in the business and dense residence section under ground. A committee could be appointed composed of representatives of the city and the electric companies to decide upon the boundaries of the districts. Other sections to be placed under ground as fast the business warrants it

The foregoing, of course, would require intelligent and careful legislation.

Telegrams as Evidence in Court.

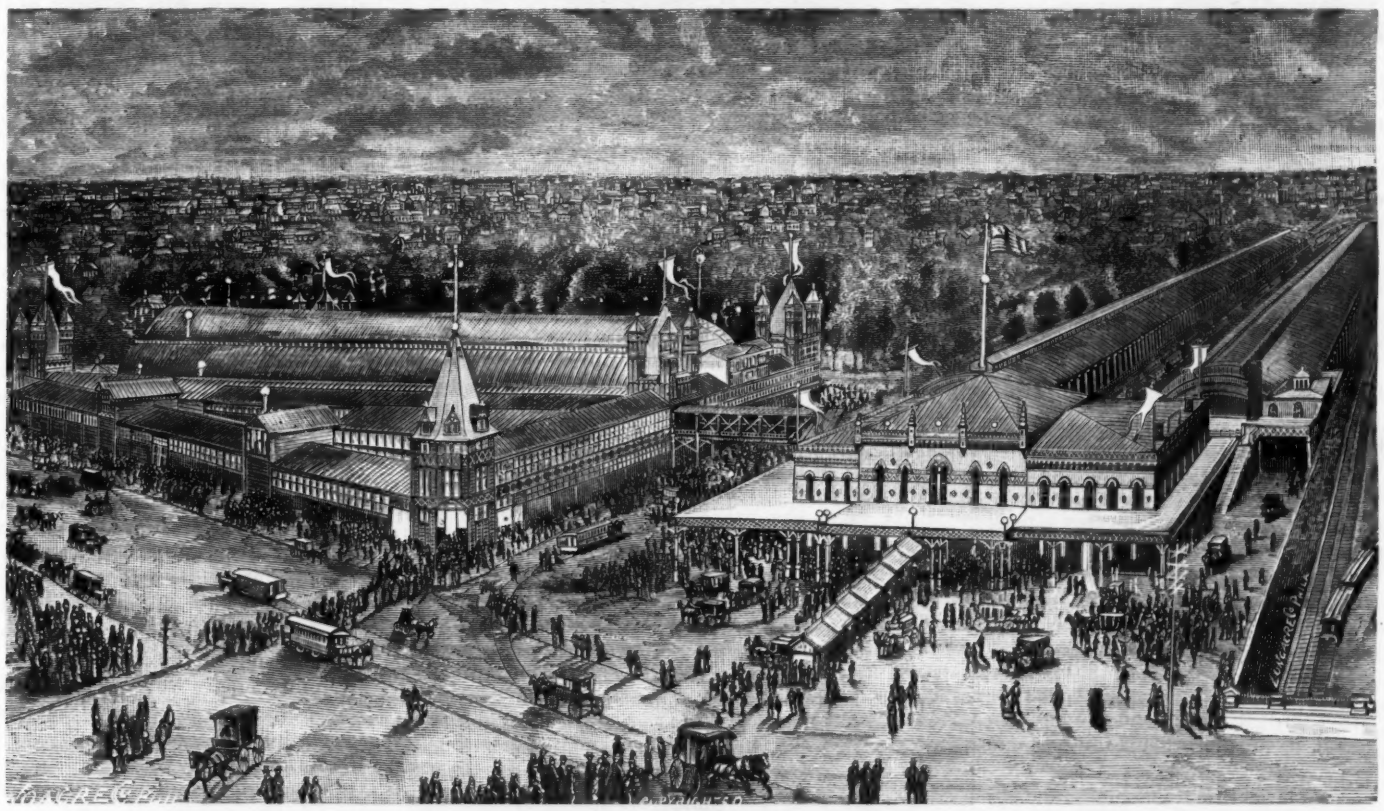
It will be remembered that in connection with the alleged attempt to bribe Canadian legislators, Mr. Dwight, the manager of the Great Northwestern Telegraph Company, was called upon by the court to produce certain telegrams, but refused to do so. The Montreal *Witness* of July 17th, says on the subject: In order to prevent his being compelled to produce the telegrams bearing upon the bribery case, now before the courts, the manager of the Telegraph Company, Mr. Dwight, declared that he had destroyed them all. Mr. Dwight did not seek in any way to hide the fact that he had expressly and purposely destroyed the papers in order to prevent their being produced. By his own admission the Company was in the habit of preserving all such papers for six months, but he had made an exception in the case of these telegrams, and had destroyed them three weeks ago, or since he had been called upon by the Police Magistrate and by the Legislative Committee also, if we remember aright, to produce them in evidence. The telegrams were of an ordinary character. "The company," he said, "treated all telegrams as private, but, to the best of his knowledge, those in question were not marked private." We suppose that the legal question as to the contempt of court involved in the act of destroying evidence, if any such offense has been committed, will be easily settled. The refusal of the Telegraph Company to produce the messages need not arouse suspicion as to the nature of their contents. It must be remembered that the company may be acting entirely in its own interests. If the public became convinced that all messages sent by telegraph would be liable to be produced in evidence against the senders and the receivers, and be made public any time within six months, the wires might not be so freely used for the purposes of transmitting messages of any important character. The company could hardly reassure the public by destroying all messages immediately they were sent, as they are needed by the company at times as vouchers of the correctness of the transmission and as evidence of debt. We have never been able to see why a message in the hands of a telegraph company should not be held as sacred as a letter in the post. All suspicions, therefore, against the accused or against the Dominion Government as having instigated this refusal would evidently be unfair.

The Portable Telephone.

Considerable progress has been made with the portable telephone apparatus invented by Capt. Lina Beecher, and protected by the broadest patents. The business in connection with the foreign patents is now being attended to, and as soon as these patents are secured, negotiations will be entered upon with the various governments, fire departments and other authorities for purchase and use of the apparatus.

A test was made recently with the apparatus between Medina and Buffalo, N. Y., a distance of about fifty miles. At Medina, Captain Beecher had his reel and an Edison telephone, and on connection with the trunk line he carried on conversation with the utmost ease with S. H. Coles, manager of the Bell Company at Buffalo. The experiments demonstrated that as the apparatus has a metallic circuit, connection can be made at any point with any telephone line, or a telegraph line even, worked by an enemy in war, and the message taken off without detection. Experimental apparatus was also exhibited by Captain Beecher at the office of this journal, 9 Murray street, during the present week, when two gentlemen, both moving about several yards apart, in different rooms, were able to converse freely by means of it.

We understand that the portable telephone will have a place in the Electrical Exhibition at Philadelphia, when it will no doubt prove one of the most interesting and attractive features. The stock of the American Portable Telephone Company is at present practically out of the market; none has been sold of late at less than par.



A VIEW OF THE ELECTRICAL EXHIBITION BUILDINGS, PHILADELPHIA, PA.

The Lighthouse Tests.

The lighting experiments at Tompkinsville, Staten Island, will be continued for several weeks. "Our results, so far, have been very satisfactory," said Lieut. Millis, "and lead to the conclusion that the electric light may be adopted with advantage for the first order of light-houses. There is no doubt that the electric light is absorbed in greater proportion in foggy weather than the light from the oil lamps, but, as it is much more intense, it can suffer this loss and still possess greater penetrating power than the old-fashioned light. Its cost is, of course, much greater than that of the oil light, but in effectiveness it promises to make up for the additional expense. The fact that it flickers is not a fatal defect. It is sufficiently steady to prevent its being mistaken for a flash light, which totally disappears at regularly recurring intervals. It requires a specially constructed lens, of course. Those lenses now in use are made for a flame of several inches in length, whereas the electric spark is comparatively but an incandescent point. Our report will suggest some improvements, and will probably favor the adoption of some system of electric lighting for the larger coast lights. I am not prepared to say which, if either, of the dynamos now being experimented with will be recommended. The Gramme, Siemens, and De Meritens are French, and are in use in French light-houses. The Elphinstone-Vincent is English."

Mr. Joseph Funck, who has been connected with the Light-house Department for thirty years, and is now foreman of the Staten Island works, whence are issued all the Government lights upon the entire coast line, does not express much confidence in the availability of electricity for coast lighting.

"To begin with," he said, "one electric light costs as much as eight oil lights of the same grade. I visited the South Foreland Light in England in 1878. It is the only electric light on the British coast, and is kept up at enormous expense. There is a complete duplicate of the entire electric plant in case of accident, and in addition to this oil lamps are kept constantly ready in the event of a total electric collapse. Five men and a chief are required to attend the lights, and 1,800 pounds of coke are consumed every twenty-four hours. Two men and a chief, and a few gallons of kerosene oil at fourteen cents per gallon, would run the same light-houses with oil lamps, and the result would be practically about as good, though of course the South Foreland lights are of wonderful power, and in ordinary weather shoot brilliant rays clear across the channel, hitting the French coast.

"We have fifty-one lights of the first order, and in all but nineteen of these we burn kerosene. In these nineteen we shall soon abandon lard oil for kerosene, which is as good, and many times cheaper. Were we to adopt an electric system the lenses in all these light-houses would have to be changed. We pay $11,000 for the Fresnel lenses of a first order light. I think the electric light might penetrate a trifle further through a fog than one from oil, but a really dense fog smothers all lights, and the only safety lies in fog whistles and bells. The advantages of the electric lights are, in a word, so small, so far as I can see, that it would not warrant the enormous additional expense of adopting them. On steamships the complaint is that they are so dazzling that seamen have a difficulty in estimating their distance, which does not exist in the case of the mellower and steadier oil light. The steamship St. Laurent gave them a trial and abandoned them."

THE VAN RYSSELBERGHE SYSTEM.—M. Cochery, French Minister of Posts and Telegraphs, announces that he intends to establish the Van Rysselberghe system between Havre and Rouen.

A HITCH IN THE CABLE.—The subjoined is from Mr. Cyrus Field's *Mail and Express:* According to London advices it appears that the new cable is not paying out quite as smoothly as its promotors predicted. One story is that Mr. Mackay put the money intended to pay for the second cable into American securities, which have recently declined so much in value that they would not realize the amount due to Siemens Brothers. Mr. Mackay is reported to have told Siemens Brothers that they must wait for their money until the securities enhance in value. London advices also state that the Mackay-Bennett cable is not showing the pugnacity it promised at its inception. People are told that the company will not receive messages for transmission until the second line under the Atlantic and the connection between Ireland and France are completed. As two months is the shortest time in which the work could possibly be done, the Mackay-Bennett cable will probably not be in operation until the fall. In regard to reductions of rates by the new line there is nothing now said.

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NEAREST TO SUNLIGHT.

We gave last week a few figures and thoughts on the subject of electric light hygiene. The article did not dwell so much on the positive merits of the electric light as it did on the positive demerits of gas, the illuminant that is most likely to hinder temporarily the general introduction of arc or incandescent systems. A few words will not be out of place now on the elements that constitute the hygienic superiority of the latest method of artificial lighting.

It is a very remarkable and significant fact that the advance in civilization has been accompanied by an improvement, *pari passu*, in the artificial light with which men have sought to beguile the tedium of the hours of darkness and to prolong the periods of toil. The invention of the tallow candle in England in the twelfth century may not be considered by some to rank as an epochal event with the land grab of William the Norman, or the declaration of independence at Runnymede, but it ought to have a high place in the history of sociological development. From the dim tallow dip to the devices of Quinquet, Argand and Carcel for lamps was a notable stride of progress in artificial lighting and it has always seemed to us interesting that just as the oil lamp in the hands of those men had reached a satisfactory stage of evolution and approximate perfection, it should be met with a formidable rival in the gas distilled by Murdoch and Lebon. Now, at this later day, having educated the eye up to a higher standard of light, but encountering more and more opposition on account its unhealthiness, gas in turn yields to electricity the first place among means of artificial illumination. Whether the world will ever get anything better than the electric light remains to be seen.

We referred last week to the table compiled by Dr. Tidy, showing the oxygen consumed, the carbonic acid produced, the air vitiated, and the heat produced by the combustion of certain bodies giving the light of twelve standard candles. To that table Mr. R. Hammond has added an incandescent lamp of equal power, and we give the figures below in full:

Burnt to to give light of 12 candles, equal to 120 grains per hour.	Cubic feet of oxygen consumed	Cubic feet of air consumed	Cubic feet of carbonic acid produced	Cubic feet of air vitiated	Heat produced in lbs. of water raised 10°F.
Cannel Gas	3.30	16.50	2.01	217.50	195.0
Common Gas	5.45	17.25	3.21	348 25	278.6
Sperm Oil	4.75	24.75	3.33	356.75	233.5
Benzole	4.46	22.30	3.54	376 30	232.6
Paraffin	6.81	34.05	4.50	484.05	361.9
Camphine	6.45	33.25	4.77	510 25	325.1
Sperm Candles	7.57	37.85	5.77	614 85	351.7
Wax	8.41	42.05	5.90	632.25	383.1
Stearic	8.82	44.10	6 25	669.10	374.7
Tallow	12.00	60.00	8.73	933 00	505.4
Electric Light	none	none	none	none	13.8

This is a tolerably complete argument in itself, but we note that when calling attention to the figures in a lecture just delivered at the London Health Exhibition Mr. R. E. B. Crompton supplemented them with some highly valuable information he had himself gathered. One instance mentioned by him was the comparative test made at the Town Hall, Birmingham, during the grand musical festival about two years ago. Some careful experiments were tried at that time to show how the performers and the audience were affected by gas and electric lighting. The candle power given by the latter was 50 per cent. in excess of that given by gas, but when gas was used, the temperature near the ceiling rose from 60 to 100 degrees in three hours. "The heating effect of the gas was therefore the same as if 4,230 persons had been added to the full audience and orchestra of 3,100. Similarly, the vitiation of the air by carbonic acid was equal to that given off by the breathing of 3,600 persons added to the audience of 3,100." On the other hand, when the electric light was used, the temperature rose only 1½ degrees during a trial of seven hours, and the air was vitiated ouly to the degree in which the audience had breathed it. Beyond this investigation, questions were put to the 265 members of the orchestra, asking how they had been affected. The replies were wonderfully unanimous as to the good results on touch, sight and voice, as well as to the greater feeling of comfort, coolness and ease. One member, by the way, made the observation that the strings of his violin were not subjected to annoying variation in pitch or otherwise, as was often the case when gas was burned and the orchestra became hot.

Another instance given by Mr. Crompton is that of the Glasgow Post-Office, where, on the introduction of the electric light, many of the sorters who were beginning to use spectacles gave them up at once, and others who had been wearing them for years were able to discard them without any inconvenience. Mr. Crompton says on this that although it has been alleged by the opponents of electric lighting that the intensity of the light injures eyesight, he does not know of any cases substantiated. He remarks, too: "Healthy eyesight demands a plentiful supply of light. It is the greatest mistake to suppose that a state of semi-darkness is good for our eyes," unless they are in some way defective; and he quotes the authority of oculists to the effect that nineteen-twentieths of eye diseases arise from using the eyes a long time with insufficient light.

If, as Mr. Crompton holds, every person during hours of waking is benefited by increase of light up to the extent of full sunlight, the superiority of the electric light must be conceded, and there are few persons who will object to the postulate. The outcry against the electric lighting systems now in vogue as dangerous to life and property has never had any sound justification. If electricity has slain its tens, gas has certainly suffocated its tens of thousands, and the value of the property destroyed by diverted currents or direct contact with bare wires could be told in three or four figures.

A NEW INTERNATIONAL HYPHEN.

We publish to-day news of the completion by the Faraday of the first Atlantic cable of the Commercial Cable Company, in which Messrs. Bennett and Mackay are so largely interested, and which will work in connection with the land telegraph companies now combined against the Western Union Company. The contractors, Messrs. Siemens Brothers, have kept their promise to have the cable laid by the middle of July, but the public evinces some disappointment at not being able to use the cable at once, as it expected. It is now stated that the Company will not take any outside public business until the companion cable is laid and the Company enters upon full possession of its plant, which will be in about a month or six weeks.

A great many expectations have been aroused by the rapid progress of the work, and the liveliest hopes are entertained by newspapers as well as business men in regard to an era of low cable rates. It is thought by some that the charge will be as low as fifteen cents a word, so that a message of ten words would cost only $1.50. At such a rate, or at 25 cents per word, a very large business can beyond all question, be done. Our own inquiries and experience satisfy us that the chief restriction of the business has hitherto been the high tariff of the companies already in the field. The general intercourse between the Old and the New Worlds has grown at a tremendous rate during the last ten years, and cable business has not kept pace with it. Low rates have never yet had a fair trial, and the public was never before so ready to avail itself of the opportunity they offer. Probably one class or other of intending patrons will be disappointed, but not for any reason distressing to the new Cable Company. Unless the rates are lowered and cut by all the competing companies, the two new cables, even when worked duplex, will have more than they can carry at the tariff mentioned, and then the social and commercial business, the *Herald* business, and the newspaper business must inevitably present conflicting claims for priority and right of way. It has become a practice with some leading daily papers to have regular cable letters from their correspondents abroad, and we know that other papers are waiting for a chance to do the same thing. There is a report, too, that Mr. Bennett, with the help of the cable, may start, as he well might, a daily edition of the *Herald* in London. Hence it is likely that the coming fall will see some very interesting developments in cable operations and journalism. As we do not believe that the laying of international cables has been overdone, we welcome this addition to the links that bind the nations together, aiding in the diffusion of knowledge and intelligence and annihilating distance, prejudice and isolation.

WESTERN UNION OPTIMISM.

There is little to add to the statement published by us last week respecting the terms of the combination between the Baltimore & Ohio, Bankers & Merchants' and Postal Telegraph Companies. The effect on the Western Union Company of this new departure has not been beneficial apparently, but the officials at No. 195 Broadway profess to view it in a spirit of optimism that would have done credit even to Mark Tapley. It is asserted that the three organizations combined will do less damage than when they stood apart, as the combination will lead to the closing of duplicate offices, and, therefore, "the fewer offices they have the less accommodation there will be for the public, and the less business they will get." A great deal depends on the way people look at things. If, as also claimed, 12,000 Western Union offices are still free from competition, the closing of the duplicate offices will enable the opposition to reach out for this field without adding to the cost of maintenance. Every needless office closed will mean a new office opened at a point where heretofore there has been no competition. No doubt, the three allies have a heavy task on hand in building up a system and plant to equal that of the Western Union. Their wire mileage, at the most favorable estimate of 120,000 miles, is only only about one-quarter that of the old Company, and it will take some time to increase 1,500 or 2,000 offices up to 13.500. But the combined companies appear determined to spare no effort or expense in getting upon an equality with their opponent, and their forces are directed by a man who has given proof of rare faculties of management and strategy.

THE ALMIGHTY'S IMPERFECT WORK.

Charles Dudley Warner has been making some critical remarks on the handiwork of the Creator. He thinks there is not a single perfect man, and has the temerity to add that there is scarcely a perfect woman. The eye is so ill-adjusted or so abnormally conditioned that he questions whether one ought to expect anything like correct observation from it. He says, too: "It appears to be still worse with the ear. It is at best a crooked organ, and nearly everything that passes through it gets a twist. And these two defective machines are allied with probably the most deceitful member that ever was—the tongue." After all, then, the evils that the telephone inspector is called upon to remedy may not always lie in the apparatus supplied by the Bell Company and known as the receiver and the transmitter, but in the human mechanisms to which the same names would be appropriate. It might not be out of place to suggest that General Thomas Sherwin, who, as auditor for the Bell Company, has already compiled many interesting tables of statistics, should supplement them with others showing the percentage of defective ears and tongues among the telephone subscribers. Or, the company might issue contract forms like life insurance applications, and according to the data returned in each case furnish an extra powerful transmitter or a super-sensitive receiver.

UNDERGROUND WIRES.

The underground wire question continues to agitate the minds of electricians and capitalists, and anything that bears on the subject is of interest. We publish this week, as timely reading, the paper read by Mr. Geo. M. Coggeshall, before the New York Electrical Society, on underground conductors for New York, and a description of the Howe underground system, about which, since its introduction to the notice of the same Society, many persons have made inquiries.

Exhibition Notes.

Rapid progress is being made in the work connected with the International Electrical Exhibition building at Philadelphia, and public interest in that city has already reached a high pitch. The Franklin Institute officers can hardly find time enough to answer all the numerous inquiries pouring in upon them from every part of the country, especially from those who wish to become exhibitors.

A set of rules and regulations has been adopted for the installation of electrical apparatus, by the Committee to which was intrusted that matter, Prof. Edwin J. Houston being its chairman. The rules aim at securing the highest possible safety to life and property, and it is earnestly requested that all exhibitors will help in carrying the rules into effect. The provisions apply to all the details of circuits, instruments, dynamos and other portions of plants, and have been most carefully elaborated.

The illustration on page 27 shows the Exhibition building and its annex as they will appear on any night while open. The view is taken from Lancaster avenue and Market street.

The Howe Underground System.

The attention of electricians and the general public in this country has of late been very much occupied with the question of the desirability and feasibility of putting all electrical wires under ground, and a wordy war has been waged between the two parties to the controversy. On the one side, there has been the tendency to make light of the many serious obstacles to the perfect working of an underground system, and on the other side there has been a disposition to deny the possibility of putting any lines underground at all. But the recent action of the Legislature and Governor of this State, in passing a law, providing that in a short time all wires shall go under ground in cities of more than 500,000 inhabitants—New York and Brooklyn—has tended to check talk, and to concentrate the thoughts of electrical companies on the practical issues of the case. Whatever may be the outcome of the present state of affairs, it cannot but be well to have it clearly ascertained whether or not good underground systems are available for use, of the nature described in the last reports of the General Committee on Underground Communication. The question is, on its intrinsic merits, not by any means limited to New York and Brooklyn, and, so far as the former city is concerned, the admirable electric railway now projected for Broadway seems to offer a solution of many of the difficulties that have been emphazied in the discussions of the subject.

Although hundreds of devices and systems have been under consideration it does not follow that the ingenuity of the country had exhausted itself at the time the Underground Committee closed its arduous but ineffective labors. One system that had not been perfected and tested early enough for inclusion in its report was brought last month to the notice of the New York Electrical Society—as mentioned in our issue of June 28—and it then attracted very favorable attention, as well for its alleged cheapness as for the eulogistic statements made in regard to it by government officials. We refer to the Howe system, described then by Mr. H. A. Sinclair, electrical engineer for the U. S. Ordnance Department, at the Sandy Hook Experimental Gunnery Station.

The Howe system is the invention of Mr. John Howe, of Tyngsboro, near Lowell, Mass., and is now for practical development in the hands of the American Underground Electric Wire Company, of which Mr. Howe is President. It comprises an insulating material, a conduit, and a device for designating wires, the whole providing what is claimed to be a thoroughly effective system of transmission and distribution, free from the troubles of induction, retardation, prolongation, etc. Several tests have been made on an extensive scale of the system, the most noteworthy being that at Sandy Hook, upon which an official report has been made, as given below:

Report from U. S. Government, Ordnance Department at Sandy Hook, N. J., on Electrical Test of Wire Insulated by Mr. Howe.

Eighteen copper wires insulated by a material supplied by Mr. Howe were laid at a depth of two feet, under sand, at Sandy Hook, to electrically connect the batteries, chronographs and target frames, used when the velocity of a projectile is to be ascertained.

Nine of the wires lie upon the bottom of a box made of rough spruce boards, the wires being separated by intervals of one inch, and fastened down by grooved cleats 18 inches apart. A second board is placed above the first, resting upon the cleats, and bears nine more wires similarly arranged.

The wires are carried thus to a joint box, where each connects with a terminal, which, by means of cotton-covered wire, is put in electrical connection with a target placed in the path of a shot.

The chronographs are generally used and two targets. A pair of wires from the upper layer in the trough lead from each chronograph to the first target, and a pair from the lower layer lead from each chronograph to the second target. When a shot is fired it ruptures the circuits at the targets and demagnetizes corresponding elements of the chronographs, which until the rupture is effected suspend weights. The falling of the weights causes a certain registration to take place, by means of which the time of flight of the projectile may be determined. For the purpose of this report no farther allusion to the chronograph is necessary, except a statement that the magnets which suspend the weights are susceptible of a very delicate adjustment, which would be interfered with if there were any inductive action between the wires; and the object of this test is to ascertain primarily this question, viz.: When any portion of the circuit is conducting a current due to the use of the most powerful battery required for ballistic purposes will the making or breaking of such a circuit induce a secondary current in adjacent and parallel closed circuits?

To ascertain this point a battery of six bichromate elements (the greatest number generally used at once), was placed in connection with eight of the upper wires which were so arranged as to form a continuous circuit, a battery key being inserted in order to make and break the circuit. The lower wires arranged also in continuous circuit, passed through the coil surrounding a galvanometer, bearing an astatic needle suspended by raw silk fibre.

When the battery circuit was made and broken no inductive effects were indicated by the galvanometer.

The arrangement was then reversed, so that the circuit which at first contained the galvanometer now contained the battery, and *vice versa*, but no inductive effects were observed. It was therefore inferred that making and breaking a circuit in which a current from six bichromate cells were used had no influence upon a closed circuit parallel to the first and separated from it by an interval of 1¾ inches.

To ascertain if induction would take place between parallel and adjacent circuits in the same layer, where the nearest wires were separated by an interval of one inch, the battery and galvanometer were arranged in the following order.

1.	12	and	13	contain	battery.	14	and	15 galvanometer.
2.	16	"	17	"	"	18	"	19 "
3.	14	"	15	"	"	12	"	13 "
4.	18	"	19	"	"	16	"	17 "

The numbers 12, 13, 14, etc., indicating consecutive wires in the upper layer. No inductive effect was observed in the closed circuit containing the galvanometer when the battery circuit was broken or made.

For testing the wires of the lower layer the following arrangement was made:

5.	3	and	4	contain	battery.	5	and	6 galvanometer.
6.	7	"	8	"	"	9	"	10 "
7.	5	"	6	"	"	3	"	4 "
8.	9	"	10	"	"	7	"	8 "

The same remarks as were made with reference to the wires in the upper layer apply to those of the lower layer. From this series it is inferred that making and breaking a circuit in which a current from 6 bichromate cells was used had no influence upon a closed circuit parallel to the first, when the nearest wires of the two circuits were separated by an interval of one inch, provided the circuits have the arrangement indicated above, which arrangement is the one always used here. In testing the wires for resistance only the resistance was found that would be expected in wire 98 per cent. pure copper, size No. 12.

As to the effect of heat and cold, moisture, etc., on this wire, no opinion can be given until after a longer interval of time has elapsed and more tests been made. These wires have been in use here since December 12, 1883.

W. S. STARRING, Captain of Ordnance.

In charge of U. S. Firing Grounds, Sandy Hook, N. J. January, 1884.

It should be added to this report that returns from the Department, dated July 2, 1884, state that the wires are still working in good condition. The company has guaranteed that they will remain intact for an indefinite period of time, and it is now negotiating with the Department to extend the system. Practice has been had with the heaviest artillery in the country, the shock of its discharge being severe enough to break windows an eighth of a mile away, although at the same time the Howe wires underground were not affected by the concussion in the least. Ordinary poles, it is said, are too liable to jolting by the shock to be of service.

Another interesting test was that made in the spring of last year by Mr. Howe, on his property at Tyngsboro, near Lowell. A trench about two feet deep, one foot wide, and making a circumference of about 515 feet, was dug around the property.

The line was first run above ground to a pole 50 feet from the house, then underground a distance of 115 feet. From that point it was carried on poles 1¼ miles; underground again 1,500 feet: and then reached the Merrimac River. It was taken across the river 1,200 feet on poles to Mr. Howe's hotel, near the river. Telephonic connection was established and satisfactory results were obtained. As a further test the line was brought back in parallel circuit, in order to utilize the facilities and to ascertain the induction, etc., to another pole 50 feet from the house. It was now laid in the trench around the house eleven times, making a total for the eleven wires of 5,665 feet added to the other portion of the circuit. Connection was then made between the wire as laid and the regular pole line from the house to Lowell, making a total distance of 11 miles. Mr. Howe called up the Lowell exchange and had great difficulty, so clear was the enunciation, in convincing the manager that the circuit had been made as above described. Beyond this, however, Mr. Howe had employed two sizes of copper wire and two of iron, gauges 12 to 20, and in order to render the test even more thorough, had cut the wire into lengths of 15 to 150 feet and joined them up promiscuously. The wires were covered simply with the Howe insulation, and thus bore all the tests of weather and exposure. A test was also made in Lowell by the Middlesex Electric Light Company. Two sections of the Howe wire were laid in wet ground, and lamps were put at each end and in the middle. Mr. J. Y. Bradbury, the manager, stated that the lights burned as well after the current passed through the buried wires as they did when the wires used ran on poles.

In cities where the troubles of underground operation are now innumerable, the company proposes to use its conduit, with a capacity of from one thousand to ten thousand wires. This conduit is in sections, and is accessible at intervals of only three feet, rendering repairs of wires or introduction of new services easy. Mr. Howe is sanguine that his system can overcome the grave difficulties inseparable from working a large number of telegraph, telephone, electric light, district messenger, and other wires all in the one conduit. One striking feature of the system is that it can be made specially applicable to railway wires, and at the present time the company is arranging to bury between the tracks, the wires of a leading New England railroad corporation.

It is to be expected that the claims made by the Howe system will arouse inquiry. If they can be substantiated—and such statements as we have given above are weighty arguments—it is evident that the estimates of cost in constructing reliable underground systems, will have to be materially reduced. The company courts investigation. Information can be obtained of Mr. John D. Beere, the Secretary, at the temporary office, 1,389 Broadway, and we understand that every facility will be afforded for inspecting the operation of the system at Sandy Hook.

REVIEWS OF NEW BOOKS.

A PRACTICAL TREATISE ON ELECTRIC LIGHTING. By J. E. H. Gordon, B. A., M. S. T. E., etc. New York: D. Appleton & Co., 1884, pp. 228. Price $4.50.

We had been led to expect great things in this book. We have found one of them in the "big I" who appears so prominently in it. A friend at our elbow suggests that there should be a dot over the big I to make it more prominent. This may be all well in its way, but four dollars and a half is too much money for a quantity of that material in a small book; even though "my '*Electricity*'" is referred to ten times in foot-notes in corroboration of statements. Now we have not examined the author's Electricity to find whether it sustains this statement on page 8: "Further, if heated in air all known substances rapidly oxidize and burn away." Our chemistry, that is, the one we own, not wrote, teaches us that such substances as platinum, gold, silver, etc., do not oxidize at high temperatures; but on the contrary, if oxidized before lose the combined oxygen when submitted to high temperature. "They oxidize and burn away;" that is to say they *oxidize* and *oxidize* away.

This is an exact work which has, according to the preface, "been in preparation for two years," yet the author has not found in all his extensive experience the contrary of his statement on page 8 that carbon "has never yet been fused." Who has not, in examining the cup, or crater, of the positive carbon of an arc lamp, seen the seething, boiling, movement of the liquid carbon therein?

Look at this statement on page 9, as to the electric arc, by one who assumes to instruct in electric lighting: "The 'poles' of the carbon rods glow with an intense whiteness, and small particles of carbon becoming detached are heated in the air between, and form a luminous 'arc' from one pole to the other which adds to the light." Examine the arc by the aid of dark glass between the arc and eye and we find that the space between the carbons is not luminous. Can he possibly mean, further, that which he says, it is the other pole which adds to the light? Which pole?

On page 66, in giving the statement as to the efficiency of the Swan incandescence lamp, this assertion is made. "The 20-candle lamps of the old pattern had each a resistance of from 45 to 150 ohms when cold, or 25 to 75 ohms when hot. They required from 1 to 1½ ampères of current, and 30 to 50 volts E. M. F." No application of Ohm's law will reconcile the discrepancies in this statement.

On page 75 the author parades again. The great "I" at one time suggested that electric light companies might write guarantees in this form: "These lamps will last for six months, at a temperature not exceeding such-and-such a horse power per square inch of surface." But he does not provide a horse-power thermometer. What is a horse-power of temperature? We know something of the horse-power of heat, but of temperature, not.

On page 115, Paccinotti (sic) is credited with having invented his armature in 1863. Pacinotti claims in his memoir on the subject the date 1860, and no one disputes the date.

On p. 115, in commenting on the fact that the attraction or repulsion produced by currents opposes the motion, he says: "We see that if this were not so we should have 'perpetual motion,' as the induced current might produce the motion which itself produced the induced current." If the earth did not revolve around the sun and rotate on its axis, it—but we forbear to contemplate the result.

On p. 140, in speaking of the displacement of the poles of the ring in a Gramme machine, he says they "are displaced by the time required for the iron of the ring to change its magnetism." A like statement is also made on p. 168. It has been thoroughly determined that the displacement is due to the current which flows around the armature core. The field-magnets induce poles in the ring 90° from those produced by the current flowing in the coils of the ring. Consequently the polar axis of the ring is the resultant of these two forces.

The reader is told on page 140 that the collector of a machine "is made of a barrel of wood or other insulating material." We are reminded of the old lady's son who "made a fiddle all out of his own head and had wood enough left to make another." New York citizens who see barrels of wood in wooden barrels might think that a collector made of a barrel of wood must be a thing of size if not of importance.

This book has its full complement of algebraical formulas, at least as many as the average of other books on the subject of electric lighting. Yet in relation to one of the easiest of the lot the reader is, in a foot note on page 138,

gravely advised as follows: "The student who is unfamiliar with algebra is advised not to trouble himself with this paragraph, as it is only a different way of stating what has already been stated in words." If this advice is applied to other parts of the book, all that is worth $4.50 will become not troublesome. Whatever is of value in this book and which cannot be had better and more fully told in other and cheaper publications lies in the algebraical and arithmetical formulas presented for use in calculations. The rules are generally well stated and are in the main correct so far as we have had time to examine them. But we must say that we doubt the information conveyed on account of the defects we have pointed out and of those which we have not.

Take this about meters for another example, from p. 202: "Edison's consists of two plates of copper in an electrolytic cell," etc. We are not told what the electrolyte is. But that is just as well, because the statement as made is not correct. Edison uses plates of zinc in an electrolyte of zinc sulphate.

According to this book "I," Swan, and Crompton are the big men in the business, though there are two or three others who have been doing a little something in the line. Therefore, for arc-lamps only the Serrin, Crompton and Brush lamps are described, and the Jablochkoff candle is thrown in as a "chromo." For incandescence lamps the Swan, Edison, Maxim and Lane-Fox are described. For dynamos the Crompton-Burgin, Brush, Siemens and Edison are set forth in description. For alternating current machines are described "*My* dynamo machine" and the De Meritens, Siemens and Ferranti.

We have said "described!" We apologize and qualify our term. Those other than "mine," Swan's and Crompton's are mentioned. Serrin's lamp has one page; Crompton's, 8 pages; Brush's, 3 pages; Jablochkoff's, ¾ page; Edison's, 1 page; Swan's, 6 pages; Maxim's, 2 pages; Lane-Fox, 3½ pages, of description or mention, as the case may be. The Crompton-Burgin machine has 2½ pages; the Brush, 4 pages, and incorrect; the Siemens, 28 lines about an abandoned style, and the Edison one page about the large central station machine, of description, etc. We are told that "the Edison Company also make small machines which work well." We wonder whether "I" ever heard of Weston or of the United States Electric Lighting Co.? In the little world in which "I" lives there is no room for such as he, or Gramme, or Hefner Alteneck, and a host of other good people.

But enough of this; we want to give the best wine at the end of the feast. When we took up the book we turned as usual to the Table of Contents. Here we found twenty-one chapters and an appendix of subjects, the enumeration of which takes six of the valuable pages which sell for $4.50. These subjects include much that is of interest to the electrical engineer and the student. Judge, then, our surprise and disappointment when we met with these things we have written about, and with Chapter XIX., in the middle of a page, with space above and below. This is so unique in its way we print it entire:

"CHAPTER XIX.

"CENTRAL STATION LIGHTING.

"I had intended to write a long chapter with the above heading, but for various reasons I am not yet prepared to do so. I have, however, left in the heading for the convenience of inserting such a chapter in a future edition of this book, should one ever be required."

We wonder whether the world will ever see the promised chapter! We are put in mind of the famous chapter on Irish natural history. It runs about as follows:

"CHAPTER III—SNAKES IN IRELAND.—There are no snakes in Ireland."

The valuable things in this book are in the chapters which relate to measurements and other comparisons. The publishers, as usual with them, have done their share in the best possible style.

The Scope of the Bourseul, Reis, Bell Apparatus, Considered as Inventions.

To the Editor of The Electrical World:

SIR: In your issue of the 12th inst., in an article by Mr. E. Berliner, he asks this question, "Since when did the art as defined exist?"

As Mr. Berliner has quoted my remark, that "Every one skilled in the art knows that a Reis apparatus will transmit and reproduce words," I will undertake to answer this question.

The *ideas* of Bourseul can scarcely be considered *invention*, as they were never sufficiently defined and elaborated to prove their truth or correctness. He described in general terms a mode of transmitting speech by electricity, but gave no accurate description of devices for producing the result.

Do the methods and apparatus of Reis entitle him to be considered the inventor of the telephone? Let us consider this.

In or about the year 1861 Prof. P. Reis graphically illustrated and explained all the principles of the action of sound waves, simple and compound. The illustrations and explanations are practically identical with those shown by Prof. Bell in his patent of 1876, though this refers to, calls for and claims a system of multiple telegraphy, while Reis had in view the transmission of articulate speech. During the years from 1860 to 1864 Prof. Reis produced various apparatus that *did*, and, *it is found*, *will* transmit and reproduce speech fairly well, and such apparatus were made and sold for this purpose, according to the testimony we have on the subject. This demonstrates, as Mr. Berliner has heretofore admitted through your columns, "that the child was born." From this point it can only be a question of progression and perfection, and it does not matter as to the invention *per se*, if the *devices* at this time for carrying out the invention operated only indifferently.

We have then by Reis a thoroughly scientific explanation of principles and a reduction to practice. This constitutes invention.

If Reis and his assistants did not discover the secret of a finely adjustable apparatus and other essential devices of a perfect transmitter, it is not to be wondered at; nor does it detract from his honor as inventor of the art.

Since the Bell patent of 1877, for his magneto Telephone Receiver, which, properly constructed, undoubtedly stands at the head of the list in its class, scores of people have labored and hundreds of thousands of dollars have been expended to perfect the "Telephone." Are they yet perfectly satisfactory to producer and user? Do not even the present telephone devices often operate indifferently? and why? Mainly because of improper adjustment, and imperfect electrodes. We must consider also, that it was not until about two years after the Bell patent of 1876, for an "Improvement in Telegraphy," which has been found to show a poor form of "Magneto Telephone," that Dr. F. Blake produced his improvement upon the Reis transmitter, the widely used "Blake transmitter." I cannot understand that we are indebted to Prof. Bell for this. It is not an improvement of a magneto-telephone, but an improvement upon the Reis battery transmitter, which fully anticipates it, and the patents allowed therefor are for devices only.

We are all familiar with the description of the "Bell" invention, and especially of Fig. 7 of the patent of 1876, alleged to be the device that will transmit speech, which, as Judge Lowell has said, "is at once a transmitter and a receiver." There is nothing in this that can be construed as an anticipation of the "Blake" transmitter.

Furthermore, this invention did not operate as described. Professor Bell states in reference to the same—and he certainly should be authority—"As had been long anticipated, it was proved that the only use of the battery was to magnetize the iron core of the magnet, for the effects were equally audible when the battery was omitted and a rod of magnetized steel substituted for the iron core of the magnet." (See Prescott, p. 70.)

In consideration of this statement, what becomes of this patent of 1876? What becomes of the theory and principle of the "undulation of a continuous galvanic current in a continuously closed circuit?" None of the devices or methods described in this patent, that are new, have ever been reduced to practice, and none of them or anything like them in detail, in construction and operation of apparatus, can be found in use to-day. In fact the invention therein shown, in best form, does not and cannot serve the purpose of the transmission of speech at all, and the transmitter everywhere in use (Blake's), does not produce "electrical undulations induced by the vibration of a body capable of inductive action," the main principle of the method set forth in this patent of 1876.

Is the Reis apparatus an anticipation of the "Blake?"

I think all will admit—aside from the adjustment—they are very similar, and in principle of operation identical. With the "Blake" the same results are obtained as with the "Reis." With either, by careful construction, more careful adjustment and light contact of electrodes, words may be transmitted by speaking in an ordinary tone of voice, and upon speaking into either in a loud tone accidental breaks are caused at the electrodes, and the articulation becomes unintelligible. All admit, I think, that the "Blake" is a great improvement upon the "Reis," so also were the improvements made by Prof. Vander Weyde, in 1868 or 1869; and the duplex and quads, dynamos and electro-motors of to-day, after years have passed, are improvements upon the originals.

Mr. Berliner lays great stress upon the "speaking current." Is not the term misleading? I certainly do not know of any reference by Prof. Bell to a "speaking current," or of any new current. It is an accepted fact that all currents are undulating or of varying power, depending upon the contact-closer, and the resistance and length of circuit. I do not know of any new current in the practice of telephony. So far as I am informed, the currents used are direct battery currents, or magneto or electro-magnetic induced currents. Hence, Mr. Berliner cannot fairly claim for Prof. Bell the invention of a new or "speaking current," or a current of varying power, nor does Prof. Bell himself make any such claim. If Mr. Berliner refers to a speaking circuit, or the "continuous unbroken circuit" shown in this patent of 1876, then to come within the scope of this patent there must be used a continuously closed circuit, including a galvanic battery and apparatus that "produces electrical undulations induced by the vibration of a body capable of induction," which apparatus must serve to act "both as a transmitter and a receiver." This combination is not in use in the art as practised to-day.

Let us drop, then, this everlasting reference to and discussion of this patent of 1876, and let the American Bell Telephone Company, which owns it, cease this humbuggery and have recourse to its valuable patents upon essential devices, which its competitors will find have far greater strength for defending its business, rights and interests fairly and justly, than the preposterous claims under the patent of 1876 ever had.

In conclusion, then, my reply to Mr. Berliner's question is, that because "of the published ideas of Bourseul," which are stated "to concern nothing more or less than the electrical transmission of the spoken word," and because of their "subsequent reduction to practice by Reis," which he (Berliner) expressly admits, and because of the facts as herein stated, the art scientifically understood and demonstrated, existed certainly as early as 1864, even if the mechanical devices that "could be controlled," for perfectly carrying out the art, did not exist that early. Further, that the art and the world, for the use and convenience of a practical telephone, owe more to the labors and improvements of Messrs. Vail, Berliner, Blake, Bell (1877), Watson, Lockwood and others, than they do to the invention of Bell as shown in this patent of 1876, the most that can be claimed for which is, that it may be considered a faint foreshadowing of his really useful telephone receiver patented in 1877.

NEW YORK, July 22, 1884. CHARLES A. RANDALL.

The Theory of Magnetism.

BY PROF. A. K. EATON

Allow me to correct a misapprehension on the part of Prof. Hughes as to the scope of the statement quoted from Faraday, in the article reproduced in your last number. The statement is as follows, "Faraday remarked that the magnetic qualities of iron disappeared at yellow-red heat (1050°C.) reappearing gradually when cooled to red-heat (700°C.)." Prof. Hughes adds that he has found that "if we heat steel to yellow-red the whole previous structure disappears and does not reappear on cooling." He is quite right in this, but has entirely missapprehended the meaning of Faraday's words. Faraday did not mean that a magnet having lost its magnetism by heating to a yellow-red would recover its magnetic character by cooling to a red heat. What he meant was that a piece of iron which, when cool was attracted by a magnet, ceased to be at all attracted when raised to a yellow-red heat but would again be, in a measure, attracted when cooled to a red-heat.

Many years since, wishing to determine the effect of tempering steel while the magnetic current was circulating through it, I heated the steel to a cherry-red, and taking it up by the poles of a strong horse shoe magnet immersed it in water while in this magnetic condition. In this way I obtained unusual magnetic intensity in the bar of steel. But on one occasion, having raised the steel to a yellow heat, I found that my horse shoe magnet would no longer lift the bar, and it was necessary to wait until it became cooler.

Briefly, then, any piece of iron or steel, when heated to a yellow-red, becomes insensible to the action of a magnet, but becomes capable of magnetization again when cooled down.

The First Commercial Cable Laid.

A dispatch of July 20, from the Commercial Cable Company's station at Rockport, Mass. says: The Faraday has completed her work of laying the first of the two Mackay-Bennett cables. A dispatch received here from the office of the company at Dover Bay says that communication has already been established between that point and Waterville, Ireland.

A series of important and delicate tests are now being made with the galvanometer. The gentlemen at the Dover Bay office of the company, who represent Messrs. Siemens Brothers, will retain charge of the cable until it has been demonstrated that it is in thorough working order. The cable between Cape Canso and this point has been under constant electrical tests for several weeks, and it is in admirable condition.

The Faraday picked up the buoy yesterday, and immediately after sighting it telegraphed the news to the office at Waterville, with which point she has been in hourly communication since she left the Irish coast. The intelligence was received with great rejoicing there. A few hours afterward a congratulatory message reached Dover Bay from Waterville. The circuit is complete and the fight against the present cable monopoly may be expected to begin at an early date. Messages have already been sent over the cable on the company's own business, but it is said that the public will not be invited to forward messages by the company until both cables are laid and in working order.

Ocean Telegraphic Apparatus.

At the Conversazione of the Society of Telegraph Engineers and Electricians, held at Kings College, London, on the 3d inst. an exhibit was made under the superintendence of Mr. Latimer Clark, and Mr. John Muirhead, showing the effect of retardation on an artificial cable equal to about 8,000 miles of the Atlantic type, at present being made for the Commercial Cable Company, (Bennett-Mackay cables.) This experiment was the more interesting as the effect of retardation had never previously been shown on so long a stretch of cable. The artificial cable was composed of a number of Muirhead's patent in-

ductive resistances and condensers, which form part of the apparatus for working the new Atlantic cables on Muirhead's duplex system. This system is also working the Atlantic cables of the Direct United States Cable Company.

The effect of retardation on this length of cable under the circumstances was very marked, the current taking about three seconds to traverse the entire line, to show a signal at the distant end. The total electrostatic capacity of the cable was about 2,400 microfarads, and the total resistance about 19,200 ohms. In addition to this exhibit there were several instruments connected with the working of the duplex also shown.

At the same time Mance's new system of testing apparatus was exhibited. This has been specially designed for fault testing on cables. The instrument is of a very compact and neat form, and should simplify the difficulties experienced in localizing faults from on board ship.

For Submarine Investigation.

MM. Imbert Frères, of St. Chamond, France, have produced a very original diving-bell, which they have named "Neptune." It reminds one of Jules Verne's Nautilus, and is admirably adapted to its purpose—scientific observations at sea. In form the apparatus resembles a huge bottle. It is 7 m. 80 mm. in height, and 3 metres in diameter. Its sides and neck consist of two steel plates, 12mm. thick, firmly riveted and bolted together. The neck contains a spiral staircase leading to the three superimposed chambers below, and is closed on the top by a steel cover through which the tubing of a pump used within for sinking or raising the diving-bell passes to the surface of the water. The cover itself is bordered with india rubber to render the bell perfectly water-tight. The compartments are separated from each other by steel sheets 25mm. in thickness, and supported by diminutive columns and angles. The upper chamber is furnished with reservoirs for compressed air, telegraphic and telephonic apparatus, electrical piles, etc. Five eye-holes, filled with strong glass, enable the engineers to look about on all sides. The middle chamber is furnished with fourteen eye-holes, with lenses for taking observations, and in the centre is a large lens, 80 centimetres in diameter, to inspect the sea bottom. The lower chamber contains the lighting and ballasting apparatus.

The electrical machinery for projecting a light in all directions fulfills a twofold purpose, for the electrical rays will undoubtedly attract the fish. The bell may be let down to a depth of 200 metres by filling the ballasting chamber with water, which is pumped out and filled with air when the divers arise.

THE TELEGRAPH.

B. & O. POLES IN NEW YORK.—On the 19th inst., Supt. of Police Walling sent out an order to the various precincts, to the effect that permits to the B. & O. Company for pole erection had been revoked, and that the company must be stopped. But the company anticipated the order and got all its poles in.

NEW DIRECTORS.—At the annual meeting of the stockholders of the Vermont and Boston Telegraph Company, held July 24, at White River Junction, Vt., the following gentlemen were elected directors: Norvin Green, T. T. Eckert, Charles A. Tinker and Roswell H. Rochester, of New York; Thomas Roche and Henry C. Sherman, of Boston; Norman Williams, of Chicago; George W. Gates and George W. Smith, of White River Junction.

ANOTHER TELEGRAPH REDUCTION.—The work of scaling down its schedule of rates is going on steadily in the office of the Baltimore & Ohio Telegraph Company. Under the terms of the pooling agreement between the Baltimore & Ohio, the Bankers & Merchants', and the Postal Telegraph, the rates of the combination are to be gradually put on the basis of the present Postal Telegraph rates. The latest "cut" announced by the Baltimore & Ohio is from New York to St. Louis, and it will take effect on Monday. The rate for day messages between those two points has been reduced to 25 cents and the rate for night messages will be 15 cents for 15 words. This, it is said, is a reduction of 50 per cent. from the Western Union rate.

A CABLE FOR NANTUCKET.—The appropriation of $20,000 by Congress for the establishment of a signal station at Nantucket and the laying of a cable connecting the island with the main land causes great rejoicing. It is believed that in the fall an additional appropriation will be secured, and that before the winter is over the island will enjoy the blessing of direct communication with the continent. No place of similar size on the continent is so isolated from the outside world during the winter season. The boats from Wood's Holl run irregularly, owing to the uncertainty of the weather, and many a person who has ventured to go to the island in the winter season has remained a prisoner there for a week or more, deprived not only of means to get away from there but of means to communicate with his family and friends. There are many wrecks off the shore of the island, and oftentimes a long time must elapse before the details are known. The value of a cable as a means of transmitting shipping news can hardly be overestimated. With the completion of the cable the island will make a new start in life and will become even more popular than it is now as a watering place. Heretofore many have kept away because of the absence of telegraphic communication.

IN THE SOUTH.—A dispatch from Richmond, Va., says: The announcement of the pooling arrangement between the Bankers & Merchants', the Baltimore & Ohio, the Postal Telegraph and the Commercial Cable companies meets with marked approval and gives general satisfaction throughout the South. The Southern Telegraph Company, which is a part of the Bankers & Merchants' combination, is already making a strong competition with the Western Union for business in this section, and, as its lines are extended, the prospect for cheaper rates becomes more apparent. This company's lines, which run from Washington to Richmond, thence to Norfolk, Lynchburg, Charleston and Savannah, have recently been extended and completed to Montgomery, Ala., and will soon be open for business at Macon, Ga., Selma, Ala., and other Southern points. The material is also being rapidly accumulated for the further extension of its lines to Mobile and New Orleans. Another branch is also being constructed from this city *via* the coast to Wilmington, N. C.; Charleston, S. C., and intermediate points, with the prospect of ultimately reaching all important points in Southeastern Georgia and Florida. The new company has received the most liberal patronage and flattering encouragement from the Southern public. This, coupled with the statement that the new pool will hasten the completion of its Southern lines and produce a consequent improvement in service and reduction of rates, gives assurance that successful competition with the Western Union will soon be opened at all points, to the advantage of the general public.

THE TELEPHONE.

CONGRATULATIONS.—We note the marriage of Capt. Lina Beecher, inventor of the Beecher mechanical telephone and the American portable telephone, and Miss Hattie B. Johnson, at Medina, N. Y., July 17, both being residents of that place.

THE TELEPHONE FOR MINES.—The telephone is extensively used in the mining regions of Silesia. Several mines and factories are connected up to a central office at Benthuen. There are 112 subscribers, and the length of lines is 1,180 kilometres. The number of calls per day is over 222.

WESTERN PENNSYLVANIA.—The Western Pennsylvania Telegraph and Telephone Company, Pittsburgh, Pa., is preparing to operate in 25 counties of the Keystone State under the Randall patents. Exchanges will be opened, says the prospectus, in Pittsburgh and Allegheny. The rates are: Business houses, $60 a year, or $50 two on wire; lawyers and physicians, $50 and $40; residences the same; all to be within one mile of exchange. The company offers to indemnify subscribers from all suits for infringement.

A VOICE FROM HOME.—In the whist room of a fashionable club in Boston recently a gentleman was told that he was wanted at the telephone. "Oh, I can't be interrupted now," he exclaimed, as he led the ace from a long suit; "ask what is wanted." The boy returned in a few moments and said: "Your wife desires you to return home, and thinks you've been here long enough." There was a loud smile, of course, and the called husband asked his partner, with a shrug: "Do you have a telephone in your house?" "Yes," was the immediate reply, "but my wife can't work it."—*Every Other Saturday.*

LIGHTNING "SHOOTS THE HAT."—Mr. J. W. McWhirter was leaning against the new telephone pole, on the corner of Trade and College streets, says the Charlotte (N. C.) *Observer*, during a storm, when there came a flash of lightning and he felt his hat jerk sharply. He pulled it from his head and found the rim in a blaze, which he quickly extinguished. The electric fluid burned a small hole in his hat that looked as if it had been made by a pistol shot. He says that he felt no shock whatever, and that it seemed as if some one had caught his hat and given it a quick jerk. Next to a telegraph pole, a lightning rod is the safest thing to lean against during a thunder-storm.

THE TELEPHONE IN NOTTINGHAM.—The Nottingham *Daily Guardian* gives a detailed description of the progress of the telephone in that large English town, and from its article we gather the following information: The National Telephone Company opened an exchange in Nottingham in September, 1881, the first line being put up on Nov. 1. At the end of that year 25 subscribers had been put into communication, and there was an average of 250 calls per day. The exchange has now 140 subscribers, the average number of calls being 1,000 daily. Over 350 miles of wire have been erected within a radius of 14 miles. The local branch of the company has also constructed lines at Burton-on-Trent, Louth, and Cromford, and is anxious to extend into other parts of Derbyshire, Lincolnshire, Leicestershire, and Notts. An endeavor has been made to establish communication between Nottingham and Loughborough, but as there is opposition from private sources that object has not yet been achieved. The corporation has availed itself to the full of the new means of communication, all the police stations and the public offices associated with the various departments being linked to the exchange, and to one another. The electricity required is generated by water force, and Gilliland's switchboards are in use, never having failed during the two years they have been in operation.

THE MELBOURNE, AUSTRALIA, TELEPHONE EXCHANGE.—The improvements now in progress in Melbourne promise, says the English *Electrical Review*, to give that city one of the best-equipped telephone exchanges in the world. A new building has been constructed by the Telephone Exchange Company, on freehold land bought by them for the purpose, about half a mile from the old office in the Melbourne Exchange, and so chosen as to make the new office as nearly as possible the centre of the square formed by the city. The principal feature of the new office is the switchboard, which is the "Multiple" now so largely used in America, and already to some extent in Europe. The Melbourne switchboard is mounted complete for 1,000 subscribers, although the exchange has only three-fourths of that number at present. So confident are the managers of the company in the growth of their business, that they have made the switchboard with an ultimate capacity for 3,000 subscribers. As now fitted up for 1,000, the switchboard consists of five sections, for 200 lines each. As some of our readers are aware, the peculiarity of the "Multiple" system consists in bringing every wire in the entire exchange, whether 500 or 5,000, to each section of the board; so that every operator has the entire number of subscribers within his reach. The economy thus effected in the number of employés and in the time required for making connections, is really wonderful. This system has recently been introduced at Liverpool, and we hope shortly to give a full description of the installation there. The transfer of the wires from the old office to the new in Melbourne is a work of no ordinary magnitude. To carry some 700 wires through the streets for half a mile was out of the question; so it was decided to lay lead-pipe cables underground, and the required amount of cable, of the Patterson form, is now on the way to Australia. The work is being carried out by Mr. Draper, superintendent of the company, assisted by Mr. Warner, of the Western Electric Company.

THE ELECTRIC LIGHT.

THE Wilhelm Theatre, Cologne, is to be lighted with electric lamps.

LOUISVILLE, KY.—The Siemens Electric Lighting Company, with a capital of $200,000, has been organized at Louisville, Ky.

SCISSORS ON STILTS.—The hook and ladder companies at Lowell, Mass., have been supplied with an instrument for cutting electric light and telegraph wires. It consists of a pair of wire cutters, attached to a long pole, which are operated by a lever at the handle.

A BRAZILIAN MAN-OF-WAR.—The "Riachuelo," a new Brazilian armor-clad turret ship, is said to be the most perfect man-of-war afloat. She is lighted throughout with Swan lamps of 20 candle-power each. The electrical machinery and appliances were furnished and fitted by the Siemens Brothers.

PORTLAND, OREGON, will shortly be lit by electricity. The initiatory plant consists of three fifty-light United States dynamos, driven independently by three Westinghouse automatic engines of 65 horse-power each. The engines will also on this occasion each have an additional twenty-light dynamo. The boilers are on the ground floor the engines on the second, and the dynamos on the third floor. For compactness, it is doubtful if there is a better designed station in the country.

ON THE PEOPLE'S LINE.—The Edison electric light is now being introduced on the People's Line of steamers from New York to Albany. The steamer St. John has the light in her main gangway aft, also through the dining saloon, thereby doing away with gas and the heat of the same, making the saloon comfortable in the warmest of weather. The light will be introduced on all the steamers of the line as fast as the work can be done under the circumstances. The light is very soft and pleasant to the eyes, and, at the same time, very brilliant, making the saloon doubly as light as formerly, with half the number of burners.

A POPULAR LAMP AMONG PHYSICIANS.—The wonderful little electric lamp devised by MM. Hélot and Trouvé for the purpose of projecting a powerful beam upon the interior of the throat and fauces, has become very popular in Paris as an assistant in the diagnosis of diphtheria, tonsilitis, croup, etc. It requires only six cells to maintain the light, which is inclosed in a camera, with a concave reflector behind it, and fixed to the forehead of the doctor by means of a curved plate and head-band. The nostril and ear can be examined with it as readily as the larynx; and the beam being whiter, clearer and less vibrating than that of the Argand burner, as well as more powerful, the liability to error incident to the latter is measurably eliminated.

COMMODORE BENNETT ON THE SEINE.—Mr. James Gordon Bennett is at present navigating the Seine in his yacht, which is a real marvel of equipment. The other day he made a trip to Rouen in company with a number of the best society people, his guests. He had on board an electric lighting apparatus of so great power that at a distance of eight kilometers it throws a ray of light so intense that the sun seems to rise at the spot it illuminates. With this apparatus he lighted up from the Seine the Cathedral of Rouen so completely that the time could be told from the steeple. Imagine the bewilderment of the people living around the old pile on seeing it suddenly illuminated in the middle of the night. A little more and it would have been regarded as a miracle.—*Gaulois.*

SLENDER SKY SCRAPERS.—It is worth while, says the Detroit *Free Press*, to watch the progress of erection of those tall electric light towers. The way these slender sky scrapers are put up is very ingenious. Contractors seem to have taken a lesson from that tallest of trees, the palm. The palm tree runs up a section at its full diameter and has its clump of foliage on top; then another and another section grows up, always keeping the clump at the upper end. So do the electric light people build. Every hoist sends their clump of lights a section higher, and working from the bottom they shoot up into the air—shooting slowly, it is true, but effectually. There is always an admiring crowd around the base of the monument. People like to see something new.

PLEASING THE SCHOOL TEACHERS.—More than 5,000 school teachers have been in convention assembled at Madison, Wis., this month. The Wisconsin *State Journal* remarks: The Van Depoele system of electric lighting, as demonstrated in this city during the past two nights, gives the most general satisfaction for its steadiness and power, and the attendants upon the National Educational Convention have almost universally bestowed upon it the warmest commendation. Twenty of the lights have afforded abundant illumination, not only to the interior of the capitol, but to the streets surrounding the park and to a greater portion of the park itself, where the trees did not interfere. The several lights upon the dome have formed a beautiful sight, visible for miles around, and their intense brilliancy has been sufficient to cast a distinct shadow at the State University—one mile distant. The lights were erected under the direction of Geo. S. Bowen, general superintendent for the Van Depoele Company.

ELECTRIC LIGHT AT HARTFORD, CONN.—A dispatch from Hartford, Conn., of July 21, says: The principal ownership in the capital stock of the Hartford Electric Light Company, hitherto owned by the American Electric and Illuminating Company of Boston, by whom the plant was built, to-day passed into the hands of a strong financial syndicate, composed of Hon. Wm. H. Bulkeley, lieutenant governor of the State; Hon. Morgan G. Bulkeley, president Ætna Insurance Company and Mayor of Hartford; Thos. O. Enders, president of the United States Bank; Austin C. Dunham, vice-president Willimantic Linen Company; Wm. A. Healy, president of the Pratt and Whitney Machine Company; Judge George S. Gilman, Connecticut Mutual Life Insurance Company, and Charles H. Owens, attorney-at-law. The sale has been under negotiation for the past three months, and the papers were

finally executed to-day by the syndicate and President Goff of the American company, who was here to-day for that purpose. The sale and transaction is one of more than ordinary importance. While it is highly advantageous to the American company, as it disposes of another large station at a good profit, it is of far greater significance, as it allies some of the strongest and best business men in New England to the American company and to the electric lighting interests generally. In Hartford, more than any city in the United States, has the gas interest pitted itself against the introduction and progress of the electric light, and the victory won by the electric light has been complete in every respect. The Hartford company is organized under a special charter granted by the Legislature, with a capital of $100,000.

MISCELLANEOUS NOTES.

AN ITALIAN MAGNETIC OBSERVATORY.—The Italian government proposes to found a central magnetic observatory at Rome, to be placed under the direction of the Meteorological Office. The government asks for a vote of 176,000 francs, in addition to an annual sum of 5,505 francs for general expenses and 11,500 francs for *personnel*.

WIRES IN CHICAGO.—The City Council of Chicago passed an order on July 21 directing that all Mutual Union telegraph wires running into the city be cut. It was stated that when the wires were cut a year or more ago the company agreed to put its wires under ground; that no attempt had been made to do so; and that additional wires were being strung. This order is subject to the approval or veto of the Mayor.

ELECTRICITY FROM DRIVING-BELTS.—It is the opinion of the Electro-Technical Society of Germany that the question whether driving-belts can generate a sufficient amount of electricity to cause dust explosions in flour mills by the resulting sparks, can be determined only by repeated and careful experiments, although the possibility cannot be denied. Such an electrical phenomenon originates generally when a glued belt runs on a pulley which is sprinkled with some resinous substance; on the other hand, it is very seldom found where a well-sewn belt runs without slipping.

A CLEVELAND STREET RAILROAD.—Work on the experimental electric street railway on Garden, New and Quincy streets is progressing rapidly, says the Cleveland, O., *Iron Tade Review*, under the direction of the inventor, Mr. Walter H. Knight, who has for some time past been perfecting his apparatus in the Brush Electric Co.'s works. One car is now completed, and the work of putting in the channel between the tracks for receiving the electrical conductors is being pushed as rapidly as possible. It is now promised that the first car will be run over the tracks by next month at farthest. A speed of 15 miles an hour can, it is said, be attained. A Brush dynamo will generate the current, which will be carried to the motor on the car by means of copper brushes. If the experiment is successful, the motor will be adopted by the East Cleveland Street Railroad Co. This is the first electrical street railroad in the United States.

SUICIDE OF M. VOLKMAR.—A dispatch of July 22 from Paris says: The body of the well-known financier Volkmar was found in the Seine to-day with a bullet through his head. His ring, which was a valuable one, and all his money, except 50 centimes in the waistcoat pocket, were missing. Volkmar had recently been greatly depressed on account of monetary troubles. He was last seen on Thursday last at midnight in the Pavilion Henri Quatre, in the Rue St. Germain, with a lady with whom he is supposed to have had intimate relations. M. Volkmar went to New York in 1881 and lent £2,000. He then proceeded to London, where he pushed the Faure Accumulator Company. He sold his share in the company for a comparatively small sum and came to Paris. Here he speculated on the Bourse, and despite losses, he recently declared that he had a monthly income of 4,000f. The theory of murder is favored, because Volkmar's pistol was found in his residence untouched. If he committed suicide, he must needlessly have purchased another pistol. The affair causes a great sensation here.

THE SUPPLY OF COPPER AND LEAD.—The supply of foreign copper and lead is a matter of considerable uncertainty, chiefly because of the unscientific manner in which mining operations are conducted. American enterprise is being engaged, to teach foreigners how to work. One mine, that of the Panulcillo Copper Company, after very careless mining for several years, under the advice of American miners, has introduced rock drills, by which the production is saved from a very heavy falling off. Notwithstanding the haphazard way of managing, foreign companies have paid heavy dividends. The Rio Tinto mine is already hampered with a large funded and floating indebtedness. The Cape mines are strained to pay dividends, at the present low prices, even with their rich ore. The Mansfeld Corporation of Germany, the largest producer in that country, continue prosperous, notwithstanding the drawback of a very thin bed. The larger mines require the best management in order to make satisfactory returns, and it is necessary that their equipment should be complete, as they must work a large amount of low grade material. Many mines in Spain have been compelled to close down, on account of the lack of facilities for this purpose. The output of the German mines last year showed a falling off of 1,000 tons, as compared to 1882.—*Industrial Review.*

UNDERGROUND WIRES.—If the Railroad Committee had disposed of the Junction Railroad difficulty in time yesterday it was expected that the matter of underground wires would be taken up for consideration. Some time ago an ordinance was introduced into Councils notifying all telephone, telegraph and electric light companies to put their wires under ground within six months after its passage. The matter was referred to a sub-committee, which reported the ordinance affirmatively. The Railroad Committee on Wednesday last took no action upon it, but posponed its consideration until yesterday, in order that those interested might have a hearing.

A letter was presented at the meeting from William A. Stern, of the Pittsburg Electrical Company, but no action was taken on it or the ordinance. The letter states that all the present systems of underground circuits are unsatisfactory, because invented by men who are not practical electricians; that every time a telephone or electrical instrument is introduced into a house both the pavement and the street opposite the house must be opened, and that doing away with poles would not settle the difficulty, as the house top lines would exist, which are in the way to firemen when working at a burning building where they are. The letter concludes by advising the city to retain experts who will investigate and try to design a good system.—*Pittsburg Dispatch*, July 10.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

TELEGRAPH.—Am. Cable, b 51, a 52; Bankers & Merchants', b 22, a 28; Mutual Union, b 12¾, a 14½; Western Union, b 58⅛, a 58⅝.

The noticeable feature of the week is the strength suddenly developed by stocks generally. It is said that Mr. Gould and others have been "pegging things up." On Thursday Western Union stock received great attention, going up from 56⅝ to 58⅝, and 39,780 shares were reported sold.

TELEPHONE.—American Bell, a 155¼; Erie, a 17¼; New England, a 21¾.

The Boston *Herald* of July 24 says: "Bell telephone barely felt the changed tone of speculation, selling at 155@155¼. The net output of telephones for the month ended July 20 was 2,278, against 5,846 in 1883, making for five months of the fiscal year 19,604, compared with 31,723 last year, a decrease of 12,119, but the earnings continue increasing all the same."

The spurt in New England telephone was succeeded by a reaction, on sales at 22½@21¾. Erie improved to sales at 17¼.

The Boston *Traveler* remarks: "New England telephone has taken an upward start. The advance has no particular significance, and is in reality somewhat strange in view of the fact that the directors voted a few days since to pass another dividend. So far as can be learned, the floating debt of the corporation has not been materially reduced since the policy of 'forcing a loan,' as some one well terms it, was adopted, but the dividend money has been used almost wholly for construction purposes. The aim of the company is to get its plant to the highest possible point of perfection, and it is certainly making long strides in this direction. The recent increase in the number of subscribers has been very gratifying, and it would seem, all things considered, as if the current quotations on this security were considerably below its actual value."

It is now expected that no decision in the Bell telephone litigation will be reached this year.

ELECTRIC LIGHT.—American, b 10; Edison, b 80, a 100; U. S., b 75, a 95.

Boston advices of July 20 say: The preferred common stock of the American Electric & Illuminating Company is becoming a favorable investment on the market, and much higher prices are predicted. To-day's financial article in the *Sunday Courier* says the American Electric & Illuminating stock is very firm and scarce in the market. The preferred holds up strong at 10, and in view of the dividend near at hand, is low at that. The common stock is a fraction higher at 2⅝, and not a single share was offered by auction to-day as suggested last week. The stock is becoming more popular with investors, and all that is offering is quickly taken out of the market. Its advance on its merits is almost certain.

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About.
American Bell Telephone	153	New England Telephone	22
Mexican Telephone	18	Globe Telephone	15
N. Y. & N. J. Telephone	53	Postal Telegraph	6
Erie Telephone	17		

BUSINESS NOTICES.

THE CUMMER ENGINE.—The Cummer Engine Co., Cleveland, O., have issued a circular intended to meet other circulars charging misrepresentation on their part in advertising that they took first premiums at the Louisville and Cincinnati Expositions for "the best automatic engine." Their circular gives the names of the competitors in each case, with full data as to applications, numbers, groups and classes. The entries reproduced in the circular imply that the several companies entered for the same premium. The circular is written in very spirited language, and makes interesting reading.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED JULY 8, 1884.

Binding Post for Electric Wires; John Young, of Chicago, Ill., Assignor to the Western Electric Co. 301,635
The posts are screwed into a floor under a carpet. They protrude enough to be felt through the carpet. The connections are made by plugs which are thrust through the carpet.

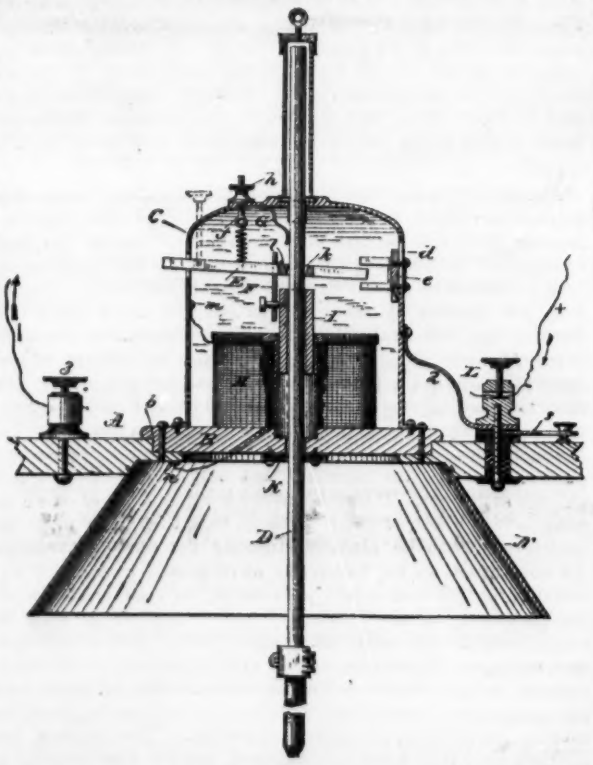
Combined Fire Alarm and Time Detector; J. A. Tilden, of Hyde Park, Mass. 301,645
The peculiarity is that the same wire and battery serve to give an alarm in case of fire and to check the inspection-visits of the watchman from time to time.

Conducting Cord for Telephones; M. G. Kellogg, Hyde Park, Ill., Assignor to the Western Electric Co., of Chicago, Ill. 301,499
A method of covering telephone cords, by which the bifurcating of the cords is effected with a greater economy.

Electric Arc Lamp; C. M. Ball, of Troy, N. Y. 301,550
There is a helix in a shunt circuit, and the carbon-holder and the gearing and frame connected with the same are supported upon a spring. The armature of the electro-magnet is connected with this frame, so that the carbon-holder is moved by the action of the magnet to bring the carbons into contact. The spring then forms the arc by lifting the carbon as the current passes through the carbons, and the magnet weakens. The train of gearing is held by a spring-brake, and the brake is liberated to allow the carbons to feed whenever the magnet is energized beyond a certain normal condition of strength. The carbon is under the control of one magnet and all the functions required are performed by the same.

Electric Motor; C. A. Jackson, Lawrence, Mass. 301,602
Rotary motion is imparted by two or more forked escapement pieces which engage as they vibrate with V-shaped teeth of wheels.

Electric Arc Lamp; C. M. Ball, of Troy, N. Y. 301,551
The current from the dynamo enters the lamp through the binding-post *L*, in metallic connection through the metallic strip 2 with the casing. The wire of the helix being connected with the casing at *m* by one terminal, and with the cross-bar at *n*, a closed circuit is established between the binding-posts *L* and 3. The helix, composed of a considerable length of very fine wire, when the lamp is in circuit, offers a path of high resistance between the poles of the source of electricity. On the passage of the current through the lamp, the attraction of the coil for its core tends to draw the same downward within the cavity of the solenoid, thereby causing the clamping-plate to release its grip upon the rod of the carbon-holder, and thus allow the rod with the carbon to descend. The tension of the spiral spring elevates the outer end of this clamping-plate, thereby causing a biting action or grip upon the carbon-carrier rod, and sustains the same, so



that when no current is passing the points of the carbons are always separated. It will be noted that the carbon-carrier is moved in one direction or the other, in whichever direction the force predominates, except as limited in a downward direction by the points of the carbons coming in contact, and when this latter takes place, a path for the current of low resistance is opened through the carbons and frame to the connections of the circuit, and as a greatly larger proportion of the current will then pass through this path, the attractive power or force of the coil is greatly weakened, and the retractile or coil spring is permitted or free to act in elevating the carbon-carrier to produce the voltaic arc. As the resistance between the carbon points increases by reason of the wasting of the carbons, the attractive force of the helix is increased, which causes the core and its connected clamping means to descend until arrested by the contact with the stop device. The clamping-plate then releases its grip upon the carbon-carrier and allows the carrier to feed, and when the contact is made to establish the arc, the tension spring attached near the outer end of the clamping-plate will cause the same to be raised and again grip the carbon-carrier for the next downward movement.

Telephonic Switch Board and Connections; E. W. Smith, of Newark, N. J., Assignor to the Overland Telephone Co., of New Jersey. 301,529
Consists in means for making temporary connections, and in the construction, arrangement and operation thereof.

Telephone; Nathaniel Parks, of Deansville, and F. J. Callanen, of Utica, N. Y. 301,749
Consists in its main feature of a tubular carbon supported loosely on trunnions.

Electric Stock Indicator; A. B. Smith, of New York city, Assignor of three-fourths to John W. Dexter, E. Dexter and E. G. Knight, all of New York. 301,763
An indicator or annunciator which prominently exhibits to a large number of observers, at once, quotations of sales and prices of stocks as they successively take place.

Telephone System; W. A. Jackson and W. R. Cole, of Detroit, Mich., Assignors to the Western Electric Co., of Chicago, Ill. 301,603
Consists in various modifications of apparatus, arrangement of parts, and grouping of all.

Telephone System; W. A. Jackson and W. R. Cole, of Detroit, Mich., Assignors to the Western Electric Co., of Chicago, Ill. 301,604
Consists in the construction and arrangement of automatic switching mechanism, whereby a large part of the manual work of connecting two subscribers' lines is done away with.

Railroad Electric Signal Apparatus; C. A. Scott, of Boston, Mass., Assignor to the Union Switch and Signal Co., of Pittsburgh, Pa. 301,827
Mechanically actuated signals, combined with electric locks, and with alarm-bells and recording mechanism.